

AMENDMENTS TO THE DRAWINGS:

The attached sheets of drawings include changes to Figures 1a and 1b to overcome the Examiner's objections by providing a "PRIOR ART" legend for Figures 1a and 1b. This sheet which includes Figures 1a and 1b replaces the original sheet which includes Figures 1a and 1b.

Attachments: Replacement Sheet

Annotated Sheet Showing Changes

REMARKS

Claims 35-57 are all of the claims presently pending in the application. Claims 52-57 have been added to claim additional features of the invention. Claims 1-34 have been canceled without prejudice or disclaimer.

It is noted that the claim amendments are made only for more particularly pointing out the invention, and not for distinguishing the invention over the prior art, narrowing the claims or for any statutory requirements of patentability. Further, Applicants specifically state that no amendment to any claim herein should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

The Examiner has rejected claims 45-47 under 35 U.S.C. §112, second paragraph, as being indefinite. The Examiner, however, has not made a prior art rejection of claims 45-47. Therefore, Applicants assume that claims 45-47 would be allowable if the 35 U.S.C. §112, second paragraph is overcome.

If claims 45-47 were not meant to be considered allowable subject, Applicants respectfully submit that when the degree of uncertainty of claim language rejected under 35 U.S.C. §112, second paragraph is not great, an appropriate course of action for the Examiner is to also enter a rejection of the claims over the prior art (see MPEP § 2173.06). Applicants submit that because claims 45-47 were merely rejected as indefinite based on a lack of antecedent basis for the phrase “the identical interconnect”, the degree of uncertainty of the claim language was clearly not “great”.

Therefore, as mentioned above, Applicants have presumed that the subject matter of claims 45-47 is allowable. If, however, claims 45-47 do not contain allowable subject matter, Applicants respectfully submit that the Examiner’s next office action include a prior art rejection of claims 45-47 and that the next office action will be a non-final office action.

Claims 45-47 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite. Claims 35-44 and 48-49 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Uzoh et al. (U.S. Patent No. 6,465,376) (hereinafter “Uzoh”). Claims 50-51 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Uzoh.

These rejections are respectfully traversed in the following discussion.

I. THE CLAIMED INVENTION

The claimed invention (e.g., as defined by exemplary claim 35) is directed to a semiconductor device. The device includes a semiconductor substrate, and a dissimilar element-diffused metal layer formed on the semiconductor substrate, including copper and a dissimilar element other than copper and having a generally uniform orientation at a surface thereof.

Electromigration and stress migration have become problems in conventional semiconductor devices, even those having a copper interconnect. Attempts have been made to overcome this problem by mixing another metal in the copper interconnect. However, it is difficult, by conventional methods, to diffuse a dissimilar metal throughout an entire interconnect.

The claimed invention of exemplary claim 35, on the other hand, provides a semiconductor device including a dissimilar element-diffused metal layer formed on the semiconductor substrate, including copper and a dissimilar element other than copper (e.g., see Application at page 5, lines 12-19). The claimed invention including this feature reduces the number of boundaries between grains in the dissimilar element-diffused metal layer which increases the electromigration and stress migration resistance of the semiconductor device (see Application at page 5, lines 3-8; and page 35, line 26 through page 36, line 8).

II. THE 35 USC §112, SECOND PARAGRAPH REJECTION

Claims 45-47 stand rejected under 35 U.S.C. §112, second paragraph. The claims have been amended, above, to overcome this rejection. Specifically, the phrase “the identical interconnect layer” has been replaced with the phrase “an identical interconnect layer”.

In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw this rejection.

III. THE PRIOR ART REFERENCE

The Examiner alleges that Uzoh teaches the claimed invention of claims 35-44, 48 and 49. Furthermore, the Examiner alleges that the claimed subject matter of claims 50 and 51 would have been obvious in view of Uzoh. Applicants submit, however, that there are elements of the claimed invention which are neither taught nor suggested by Uzoh.

That is, Uzoh does not teach or suggest a semiconductor device including “*a dissimilar element-diffused metal layer formed on said semiconductor substrate, comprising copper and a dissimilar element other than copper*” as recited in claim 35 and similarly recited in claims 36 and 47-49.

The Examiner attempts to rely on column 3, lines 7-11 of Uzoh to support his allegations. The Examiner, however, is clearly incorrect.

Nowhere, in this passage (nor anywhere else for that matter) does Uzoh teach or suggest a semiconductor device including a dissimilar element-diffused metal layer formed on the semiconductor substrate, including copper and a dissimilar element other than copper. Indeed, Uzoh merely teaches a microstructure having an interconnect metal layer.

Uzoh merely discloses “[a] layer (8) of the interconnect metal such as copper,

aluminum or alloys thereof” (see Uzoh at column 3, lines 7-11). This clearly does not teach or suggest a dissimilar element diffused metal layer as recited in the claimed invention. Uzoh merely discloses a metal interconnect layer that may be made from copper or aluminum or alloys thereof.

The Examiner alleges that Uzoh teaches a dissimilar element-diffused metal layer containing copper and a dissimilar element, copper alloy. Nowhere is this taught or suggested by Uzoh. Uzoh teaches a metal interconnect layer made of a single material. Uzoh teaches that the single material of the interconnect layer may be copper or aluminum or alloys thereof. It is clearly erroneous for the Examiner to allege that Uzoh teaches a metal layer made up of two dissimilar materials.

The claimed invention teaches that the dissimilar element-diffused metal layer includes a copper layer having a dissimilar element diffused in the copper. “Dissimilar-element diffusion” is clearly not taught or suggested by Uzoh.

Therefore, Applicants submit that there are elements of the claimed invention that are not taught or suggest by Uzoh. Therefore, the Examiner is respectfully requested to withdraw this rejection.

III. NEW CLAIMS

New claims 52-57 have been added to provide more varied protection for the claimed invention and to claim additional features of the invention. These claims are independently patentable because of the novel features recited therein.

Applicants respectfully submit that new claims 52-57 are patentable over any combination of the applied references at least for analogous reasons to those set forth above with respect to claims 35-51.

IV. FORMAL MATTERS AND CONCLUSION

In response to Examiner's objections, the drawings have been amended in a manner believed fully responsive to all points raised by the Examiner.

In response to Examiner's objections to the Drawings, Applicants file herewith annotated and replacement sheets for Figures 1a and 1b, labeling the figures with a "PRIOR ART" legend.

In view of the foregoing, Applicants submit that claims 35-57, all of the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

Serial No. 10/613,069
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The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

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FIG.1a
PRIOR ART

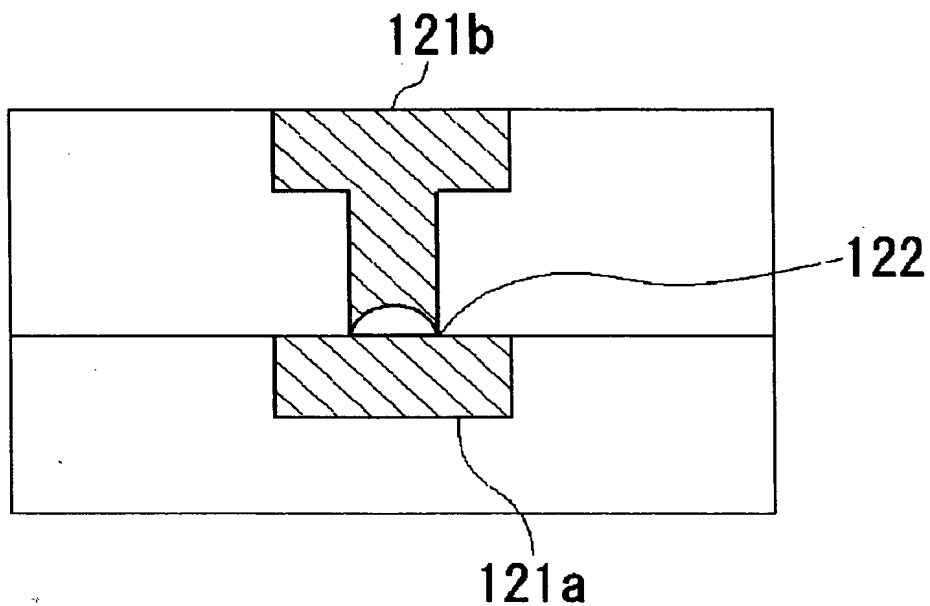


FIG.1b
PRIOR ART

